CHARACTERIZATION OF LYGUS FEEDING BEHAVIOR USING ELECTROPENETROGRAPHY

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Abstract

Western tarnished plant bug, *Lygus hesperus* Knight (Hemiptera: Miridae), is an economically important pest of cotton in the western United States. Both nymphs and adults cause damage to cotton squares and cotton bolls. Nymphs mostly prefer small squares, whereas adults feed on both vegetative and reproductive structures (Snodgrass 1998). *L. hesperus* feeding can cause fruit abortion, internal boll rot and seed injury. Lint injury impacts quality of lint and reduces lint yield (Godfrey et al. 2009). *Lygus* spp. were long considered lacerate-and-flush feeders, however, recently feeding mechanism was reclassified as cell rupture feeding (Backus 1988). Electropenetrography (EPG) is a powerful research technique to study feeding behavior of piercing-sucking arthropod pests such as aphids, whiteflies, leafhoppers, plant bugs and ticks. EPG provides the most accurate means of stylet-probing behaviors of piercing-sucking insects.

L. hesperus used in this study were raised in the laboratory. Feeding studies were conducted on potted cotton plants. Silver flake, white glue and water were used to make silver glue (1:1:1 ratio) and a gold wire (0.0015-inch) was attached on to the pronotum of *L. hesperus* to set up the experimental insect for the study. *L. hesperus* were collected in a vial and carbon dioxide was released for three seconds. Test insects were kept on to a vacuum suction pipe covered with a mesh, applied a drop of silver glue onto the pronotum and attached one end of gold wire with a round loop. When glue was dried, *L. hesperus* were starved for 1 h before releasing onto a cotton leaf. Experimental plants consisted of plants sprayed with flonicamid (Carbine 50 WG) @ 2.8 oz/acre or unsprayed control plants. ACDC monitor was used in this experiment with four channels. A single *L. hesperus* was attached on each channel (4 channels) and allowed them to feed on cotton leaves at 1, 3, 7, and 14 days post treatments for 5-18 hours (Fig. 1). Cotton plants were watered before the start of the experiment to ensure proper electrical conductivity when the insect probing occurred. These experiments were repeated three times with a total of 12 replications. Touch test on head amplifier was done to make sure all connections were secure. In all experiments, resistance was set to 10^9 © in all channels. In each replication, two channels were used to record *L. hesperus* feeding behavior on control plants and two on treated plants. For each recording, a new insect was used, however, same plants were used in 1, 3, 7 and 14 days after treatment. More than 300-hour recordings were acquired during this experiment. Probing and non-probing behavior patterns were used from Cervantes et al. (2016) to compare between the two treatments.

Figure 1. Electropenetrography setup: EPG monitor (left top), *Lygus hesperus* adult attached with gold wire (left bottom); potted cotton plants in the Faraday cage (right).

Generally, standing, cell rupture and ingestion, are three main behavior waveforms identified in previous studies (Backus et al. 2018, Cervantes et al. 2019). Compared to control plants, *L. hesperus* on treated plants appeared to walk or antennate with very few instances of ingestion (Fig. 2). This behavior may be a sign of deterrence of insecticide applied. Preliminary results from these experiments indicated that ingestion duration of *L. hesperus* was longer on control plants than on treated plants. Also, ingestion duration increased as time between application of treatments and

release of *L. hesperus* increased. Data analysis and detail characterization of *L. hesperus* feeding behavior as affected by flonicamid insecticide is ongoing.

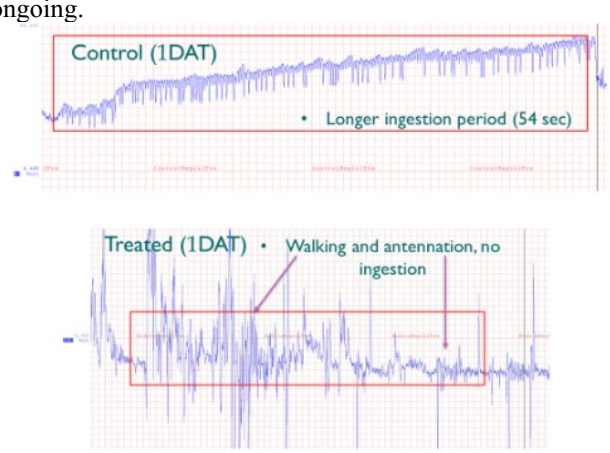

Figure 2. EPG waveforms produced by *Lygus hesperus* with AC applied signal on cotton leaf using 5mV at Ri 10^9.

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